[COMMITTEE PRINT]

# ANALYSIS OF ENERGY SUPPLY, CONSERVATION, AND CONVERSION

## HOUSE BILL (H.R. 6860) AND POSSIBLE ALTERNATIVES

## OVERVIEW

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PREPARED FOR THE USE OF THE

COMMITTEE ON FINANCE

BY THE STAFF OF THE

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# ANALYSIS OF ENERGY SUPPLY, CONSERVATION, AND CONVERSION—OVERVIEW

*U.S. energy supply and demand since World War Two*

The U.S. economy has grown rapidly in the years since World War Two, and this has been accompanied by a rapid growth in the consumption of energy, especially energy derived from oil and natural gas. The rapid growth in demand for oil and gas has also been encouraged by a decline in the price of oil, relative to consumer prices generally, over much of this period and an artificially low (although rising) price for natural gas, as well as environmental policies in recent years that have encouraged the use of these relatively clean energy sources. Until the mid-1960's, the United States could satisfy growing demands for energy from its abundant resource base; however, since then, growth in demand has led to increasing reliance on oil imports and to outright shortages of natural gas.

TABLE 1.—ENERGY USE IN THE POSTWAR PERIOD

| Year | Gross energy consumption (quadrillion Btu's) | GNP in 1958 prices (billions of dollars) | Energy consumption per dollar of GNP in 1958 prices (million Btu's) |
|---|---|---|---|
| 1947 | 33.0 | $309.9 | 0.106 |
| 1950 | 34.0 | 355.3 | .096 |
| 1955 | 39.7 | 438.0 | .091 |
| 1960 | 44.6 | 487.7 | .091 |
| 1965 | 53.3 | 617.8 | .086 |
| 1966 | 56.4 | 658.1 | .086 |
| 1967 | 58.3 | 675.2 | .086 |
| 1968 | 61.7 | 706.6 | .087 |
| 1969 | 65.0 | 725.6 | .090 |
| 1970 | 67.1 | 722.5 | .093 |
| 1971 | 68.7 | 746.3 | .092 |
| 1972 | 72.1 | 792.5 | .091 |
| 1973 | 75.6 | 839.2 | .090 |
| 1974 | 73.4 | 821.2 | .089 |

Source: Department of the Interior and Federal Energy Administration.

*U.S. energy consumption.*—Between 1947 and 1973 energy use in the United States, measured in Btu's, grew at an annual rate of 3.2 percent, as shown in table 1.[1] Between 1965 and 1973, the growth of

[1] A Btu, or British Thermal Unit, is the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit. The Btu contents of various sources of energy are as follows: crude oil—5.8 million Btu/barrel; refined products—5.5 million Btu/barrel; natural gas liquids—4.0 million Btu/barrel; natural gas—1.0 million Btu/thousand cubic feet (mcf); coal—24 million Btu/short ton; electricity—3.4 thousand Btu/kilowatt hour. The energy content of a barrel of crude oil exceeds that of a barrel of petroleum products because volume increases during the refining process.

energy consumption speeded up to a rate of 4.5 percent annually. As the table shows, energy consumption per dollar of gross national product (in constant prices) fell between 1947 and 1965, rose until 1970 and has once again started to fall.

Consumption of oil and gas, moreover, has grown more rapidly than energy use generally, as shown in table 2. Between 1950 and 1973, the growth rate in oil use was 4.3 percent annually, and between 1965 and 1973 oil consumption accelerated to a growth rate of 5.2 percent. In 1973, the last year before the sharp rise in oil prices, U.S. oil consumption grew by 5.5 percent, a growth rate that would lead to a doubling of oil consumption every 13 years. The acceleration in oil demand in the years before 1973 has been attributed to the declining relative price of crude oil, the shift of some electric utilities from coal-fired to oil-fired power plants in response to pollution controls, the unavailability of natural gas, and a decline in the fuel economy of automobiles.

TABLE 2.—U.S. CONSUMPTION OF OIL AND GAS

| Year | Consumption of | | Year | Consumption of | |
|---|---|---|---|---|---|
| | Crude oil [1] (million barrels per day) | Natural gas (trillion cubic feet per year) | | Crude oil [1] (million barrels per day) | Natural gas (trillion cubic feet per year) |
| 1950 | 6.51 | 6.28 | 1965 | 11.52 | 16.50 |
| 1955 | 8.49 | 9.41 | 1966 | 12.10 | 17.69 |
| 1956 | 8.82 | 10.06 | 1967 | 12.57 | 18.74 |
| 1957 | 8.86 | 10.72 | 1968 | 13.40 | 19.97 |
| 1958 | 9.15 | 11.17 | 1969 | 14.15 | 21.43 |
| 1959 | 9.49 | 12.18 | 1970 | 14.71 | 22.74 |
| 1960 | 9.81 | 12.93 | 1971 | 15.23 | 23.43 |
| 1961 | 9.99 | 13.47 | 1972 | 16.38 | 23.55 |
| 1962 | 10.41 | 14.28 | 1973 | 17.29 | 23.68 |
| 1963 | 10.75 | 15.15 | 1974 | 16.64 | 22.67 |
| 1964 | 11.03 | 15.90 | | | |

[1] Includes natural gas liquids.

Source: Independent Petroleum Association of America.

In 1974, U.S. demand for petroleum products fell by 3.8 percent owing to the embargo in early part of the year, the economic slowdown, higher prices, the relatively warm winters, and greater public awareness of the need to conserve energy. In the first three months of 1975, demand for petroleum products was up 1.6 percent from the artificially depressed level of the first quarter of 1974, but was 6.4 percent below the first quarter 1973 level and approximately equal to the first quarter 1972 level of consumption. The warm winter, the severe economic decline and higher oil prices are all partly responsible for the decline in oil demand so far this year.

Demand for natural gas grew even more quickly than demand for petroleum through much of the postwar period, as shown in table 2. Between 1950 and 1970, natural gas consumption grew at a compound rate of 6.7 percent per year, an overall increase of 262 percent. Since 1970, consumption of natural gas has been restrained by a shortfall in supply, so that it has not grown at all, although without the supply constraint, there is every reason to believe that demand for natural gas would have continued to rise rapidly.

*U.S. oil and gas supply.*—Until 1965 the United States had enough petroleum capacity to satisfy the rapid growth in demand. This is

shown in table 3, which presents data on oil demand, supply, capacity, and imports. The United States did import a modest amount of oil in that period, but imports were less than unused U.S. productive capacity, so that an embargo in that period would not have required a cutback in consumption. After 1959, imports of oil were limited by the Mandatory Oil Import Program, which imposed quotas on oil imports. These quotas were eased after 1970 to permit more oil imports and in 1973 were replaced by a system of oil import license fees. Since 1973, there has been no volumetric limit on oil imports.

TABLE 3.—DEMAND, SUPPLY, PRODUCTIVE CAPACITY, AND IMPORTS OF PETROLEUM, 1955–74

[millions of barrels per day]

| Year | U.S. demand for petroleum | U.S. production of crude oil | U.S. production of natural gas liquids | U.S. productive capacity for crude oil | Spare capacity for crude oil | U.S. imports of petroleum |
|---|---|---|---|---|---|---|
| 1955 | 8.49 | 6.81 | 0.77 | 8.93 | 1.78 | 1.25 |
| 1956 | 8.82 | 7.15 | .80 | 9.25 | 2.08 | 1.44 |
| 1957 | 8.86 | 7.17 | .81 | 9.49 | 2.78 | 1.57 |
| 1958 | 9.15 | 6.71 | .81 | 9.66 | 2.60 | 1.70 |
| 1959 | 9.49 | 7.05 | .88 | 9.71 | 2.67 | 1.78 |
| 1960 | 9.81 | 7.04 | .93 | 9.89 | 2.71 | 1.82 |
| 1961 | 9.99 | 7.18 | .99 | 10.08 | 2.75 | 1.92 |
| 1962 | 10.41 | 7.33 | 1.02 | 10.17 | 2.63 | 2.08 |
| 1963 | 10.75 | 7.54 | 1.10 | 10.29 | 2.67 | 2.12 |
| 1964 | 11.03 | 7.61 | 1.16 | 10.53 | 2.73 | 2.26 |
| 1965 | 11.52 | 7.80 | 1.21 | 10.74 | 2.45 | 2.47 |
| 1966 | 12.10 | 8.30 | 1.28 | 11.05 | 2.24 | 2.57 |
| 1967 | 12.57 | 8.81 | 1.41 | 11.22 | 2.12 | 2.54 |
| 1968 | 13.40 | 9.10 | 1.50 | 11.14 | 1.90 | 2.84 |
| 1969 | 14.15 | 9.24 | 1.59 | 11.01 | 1.38 | 3.17 |
| 1970 | 14.71 | 9.64 | 1.66 | 10.79 | 1.33 | 3.42 |
| 1971 | 15.23 | 9.46 | 1.69 | 10.25 | .69 | 3.93 |
| 1972 | 16.38 | 9.44 | 1.74 | 9.54 | .20 | 4.74 |
| 1973 | 17.29 | 9.27 | 1.74 | NA | NA | 6.20 |
| 1974 | 16.64 | 8.77 | 1.69 | NA | NA | 6.19 |

Note: NA =Not available.

Source: Independent Petroleum Association of America.

TABLE 4.—OIL AND GAS EXPLORATION AND DEVELOPMENT OUTLAYS AND PROVED RESERVES

| Year | Outlays for exploration and development (billions of dollars) | Proved oil reserves [1] (billions of barrels, yearend) | Proved gas reserves (trillion cubic feet, yearend) |
|---|---|---|---|
| 1955 | 4.68 | 35.45 | 222.5 |
| 1956 | 5.08 | 36.34 | 236.5 |
| 1957 | 5.10 | 35.99 | 245.2 |
| 1958 | 4.23 | 36.74 | 252.8 |
| 1959 | 4.35 | 38.24 | 261.2 |
| 1960 | 4.20 | 38.43 | 262.3 |
| 1961 | 4.00 | 38.84 | 266.3 |
| 1962 | 4.43 | 38.70 | 272.3 |
| 1963 | 4.13 | 38.64 | 276.2 |
| 1964 | 4.45 | 38.74 | 281.3 |
| 1965 | 4.21 | 39.38 | 286.5 |
| 1966 | 4.25 | 39.78 | 289.3 |
| 1967 | 4.37 | 39.99 | 292.9 |
| 1968 | 5.39 | 39.31 | 287.4 |
| 1969 | 5.25 | 37.78 | 275.1 |
| 1970 [2] | 4.78 | 37.10 | 264.7 |
| 1971 [2] | 3.90 | 35.77 | 252.8 |
| 1972 [2] | 6.48 | 33.54 | 240.1 |
| 1973 [2] | 8.14 | 32.15 | 224.0 |

[1] Includes natural gas liquids.
[2] Data on proved reserves exclude Alaska.

Source: Independent Petroleum Association of America.

U.S. production of crude oil and natural gas liquids peaked in 1970. Outlays for exploration for and development of oil reserves had reached a peak in 1957, as shown in table 4. At that time spare capacity in the oil industry was 30 percent, and further exploratory drilling had become much less profitable. As a result of the decline in exploration which began in the late 1950's, proved reserves of oil and natural gas liquids (excluding Alaska) peaked in 1967. This is also shown in table 4. More intensive use of the stock of reserves enabled production to continue increasing until 1970, but after that year the decline in production began, made inevitable by the sharp decline in exploration after 1957 and perhaps also by a declining domestic resource base. Production of crude oil fell from 9.6 million barrels per day in 1970 to 8.8 million barrels per day in 1974, a decline of 8 percent. By March 1975, production had fallen to 8.3 million barrels per day.

As with oil, proved reserves of natural gas peaked in 1967, as shown in table 4, and they have fallen precipitously since then. Owing to more intensive use of existing reserves, natural gas production continued to rise until 1973, when it peaked at 22.65 trillion cubic feet. So far in 1975, gas production is almost 10 percent below the 1973 peak.

*U.S. oil and gas imports.*—The effect of rapidly increasing demand for oil and declining domestic supply has been a sharp rise in imports of oil, as shown in table 3. Imports were 6.2 million barrels per day in 1974, or 37 percent of total consumption, despite the embargo in the early months of the year. So far this year, the decline in oil demand has exceeded the decline in domestic supply, so that imports are down slightly in absolute terms, although they are still approximately 37 percent of total consumption.

The U.S. imports a modest amount of natural gas, approximately one trillion cubic feet per year; but because natural gas imports cannot easily be increased, the decline in U.S. gas production has resulted in curtailments of service to so-called "interruptible customers," generally businesses. Many of these curtailed customers have switched to oil, thereby aggravating the oil import problem, but in other cases natural gas curtailments have led to shutdowns and unemployment.

*U.S. oil and gas prices.*—An important determinant of the supply and demand for both oil and gas is the price for which these products are bought and sold. Table 5 shows the average prices of oil and gas produced in the United States during the past twenty years. In constant dollars (that is, relative to consumer prices generally) crude oil prices rose until 1957 and then fell gradually until 1972. During most of this period, prices were determined by a combination of market forces, limitations on production by State regulatory authorities and the price of oil imports. While the oil import quotas were effective, the U.S. price of oil was relatively independent of the price of imports, which at the time was below the U.S. price; however, once the import quotas were eased after 1970, the low import price became a factor in holding down the U.S. price. With the substantial price increases initiated by the Organization of Petroleum Exporting Countries (OPEC) in 1973 and 1974, what is now the high price for oil imports (including transportation costs and any import tariffs or license fees) has become the determinant of the price of U.S. oil not subject to price controls.

TABLE 5.—PRICES OF CRUDE OIL AND NATURAL GAS, 1955–74

| Year | Crude oil price at wellhead (dollars per barrel) | | Natural gas price at wellhead (cents per mcf) | |
|---|---|---|---|---|
| | Current prices | 1974 prices | Current prices | 1974 prices |
| 1955 | 2.77 | 5.19 | 10.4 | 19.5 |
| 1956 | 2.79 | 5.04 | 10.8 | 19.5 |
| 1957 | 3.09 | 5.38 | 11.3 | 19.7 |
| 1958 | 3.01 | 5.20 | 11.9 | 20.2 |
| 1959 | 2.90 | 4.85 | 12.9 | 21.6 |
| 1960 | 2.88 | 4.74 | 14.0 | 23.0 |
| 1961 | 2.89 | 4.70 | 15.1 | 24.6 |
| 1962 | 2.90 | 4.66 | 15.5 | 24.9 |
| 1963 | 2.89 | 4.59 | 15.8 | 25.1 |
| 1964 | 2.88 | 4.50 | 15.4 | 24.0 |
| 1965 | 2.86 | 4.39 | 15.6 | 23.9 |
| 1966 | 2.88 | 4.30 | 15.7 | 23.4 |
| 1967 | 2.91 | 4.22 | 16.0 | 23.2 |
| 1968 | 2.94 | 4.09 | 16.4 | 22.8 |
| 1969 | 3.09 | 4.10 | 16.7 | 22.2 |
| 1970 | 3.18 | 4.00 | 17.1 | 21.5 |
| 1971 | 3.39 | 4.07 | 18.2 | 21.9 |
| 1972 | 3.39 | 3.94 | 18.6 | 21.6 |
| 1973 | 3.89 | 4.29 | 21.6 | 23.8 |
| 1974 | 6.85 | 6.85 | 29.9 | 29.9 |
| 1974 (Dec.) | 7.39 | 7.39 | 35.0[1] | 35.0[1] |

[1] Staff estimate.

Source: Bureau of Mines.

Crude oil was covered by the price control program started in August 1971. Currently, crude oil subject to price controls has an average price of slightly more than $5 per barrel although the actual price of crude oil varies from about $3 to about $7, depending on its location and quality. (Price increases totaling $1.35 have been granted since August 1971.) The existing price control law expires on August 31, 1975, at which time controls will terminate unless there is new legislation. Under existing law, the President can decontrol crude oil subject to a veto by the House of Congress. President Ford has submitted a plan to phase out the existing controls over a thirty-month period but to place a ceiling price on all oil ("new" oil as well as "old" oil) equal to the January 1975 price of uncontrolled oil plus $2.00 (approximately $13.50 per barrel).

Three types of oil are not now subject to price controls: new oil, released old oil and stripper oil. Old oil is defined as all oil produced on a lease up to the amount produced in the corresponding month in 1972, and new oil is defined as all oil produced on a lease in excess of this base period production. For each barrel of new oil produced on a lease, a producer is allowed to release from price controls a barrel of his old oil. Stripper oil is all oil produced on a lease whose average production per well is less than 10 barrels per day, as well as oil produced on a lease whose oil was stripper oil even if that lease now produces more than 10 barrels per day. New oil and released old oil were decontrolled by the administration in August 1973, and stripper oil was decontrolled by Congress in November of that year.

Since oil fields tend to become exhausted, eventually all oil will be free from price controls even though (by new legislation) the present two-tier price system is continued. In December 1974, controlled old oil was 66 percent of U.S. production, new oil was 14 percent, released

oil was 8 percent and stripper oil was 12 percent. There is a peculiar seasonal pattern to the percentage of old oil. In the initial months of 1972, the base year, many fields were operating below capacity because of prorationing and, therefore, have low base period levels of production for the first few month of each year. Thus, some oil that is new or released oil in the early months of the year becomes old oil in the later months, since the producer's base period production rises. Thus, even though the general tendency is towards a declining fraction of old oil, that fraction rose from 60 percent in January 1974 to 66 percent in December 1974. (As expected, it fell to 57 percent in January 1975.) This leads to a similar seasonal pattern in average prices of oil received by U.S. producers. They tend to rise in January and then fall in the latter months of the year as the fraction of price-controlled oil rises.

A more serious problem with the price controls is that as old oil fields become exhausted, production falls farther below the 1972 level. Thus, new or released oil can once again be made subject to price controls just because the natural depletion of the oil field causes production to fall below the base period level. Also, when a field is producing below its 1972 level, much or all of the increase in production resulting from secondary and tertiary recovery would be defined as old oil, even though conceptually it is really new oil. This gives producers an incentive to postpone secondary or tertiary recovery until after price controls are abolished' This problem could be largely eliminated if old oil were redefined to allow for the natural decline in production that occurs over time; for example, if old oil were defined as 1972 production minus one percent per month after 1972. (This change would eliminate controls entirely by 1981.) Similarly, if oil is decontrolled more quickly but a windfall profits tax on old oil is enacted. the effect of such a tax in discouraging production through enhanced recovery techniques could be largely eliminated if old oil subject to the tax were defined so as to take account of the natural depletion of an oil field.

New oil prices are almost as high as the landed price of imports and now exceed $13 per barrel. The average price of oil, both controlled and uncontrolled, received by U.S. producers is approximately $8. This is an increase of more than 100 percent over th 1973 price. The landed price of oil imports is now approximately $14 per barrel, including the $2 tariff. This makes the average price paid by U.S. oil consumers approximately $10.25 per barrel, which is roughly triple the 1972 prices of oil.

Natural gas prices have behaved differently. Gas sold in interstate commerce (60 percent of the total produced in the United States) is regulated by the Federal Power Commission at an average price of 33 cents per thousand cubic feet (mcf). as of December 1974. This is an average of "new" gas, whose price is approximately 52 cents per mcf, and old gas being sold under fixed contracts at much lower prices. Unregulated natural gas sells at a higher average price, and new un-

regulated gas contracts include prices over $1.50 per mcf. In addition, 4 percent of U.S. gas supply is imported at an average price of $0.75 per mcf, a price that is expected to rise sharply in the future. The average price of all gas consumed in the United States was approximately 35 cents per mcf in December 1974, a 40-percent increase over December 1973. This is substantially below the price of an equivalent amount of energy in the form of oil. Were oil selling at the same price as natural gas, in terms of its energy content, its price would be about $2.00 per barrel, not $10.25.

As shown in table 5, natural gas prices stayed roughly constant between 1955 and 1972, relative to consumer prices generally. Gas prices, however, rose by 19 percent in 1973 and another 38 percent in 1974. Further significant price increases can be expected over the next several years as old contracts with low prices expire and are renegotiated at the higher prices now prevailing for new contracts, as is seen by comparing the prices for December 1974 with the year's average price.

The large price increases for oil and gas in 1974 should be seen in the context of the cost increases that have occurred. Generally, costs have risen sharply because of inflation and increased activity in the industry. According to the Independent Petroleum Association of America, prices of oil field machinery rose 19 percent in 1974, prices of oil well casing rose 28 percent, and oil field wages rose 10 percent. In addition, costs have risen because it is necessary to dig deeper wells and to dig in more difficult areas as lower-cost oil is used up.

These cost increases mainly affect new oil and oil produced through secondary and tertiary recovery methods. For most old oil, lifting costs are a small fraction of price, so that even very large percentage increases in lifting costs do not interfere with the profitability of production from these wells.

*Forecasts of oil demand and supply*

Table 6 presents a forecast, prepared by the Federal Energy Administration, of the demand for and supply of petroleum products under various assumptions about public policy. These figures are somewhat revised from those contained in the House committee report. The "base case" forecasts assume a continuation of policies in existence prior to the President's State of the Union message, including a continuation of price controls on old oil, which is a declining fraction of total domestic oil. The base case forecasts assume that the price of oil is $11 in 1975 prices for the years 1975 to 1977 but that in 1978 the price declines to $8.35 in 1975 prices ($7 in 1973 prices). "Phased decontrol" involves a phaseout of price controls on old oil over a 30-month period, as proposed by the President. The "accelerated supply" case assumes accelerated leasing on the Outer Continental Shelf and development of the Alaskan Naval Petroleum Reserve (NPR–4), both of which have been proposed by the administration. The "H.R. 6860" case assumes enactment of the House version of the Energy Conservation and Conversion Act of 1975.

TABLE 6.—ESTIMATED U.S. OIL SUPPLY AND DEMAND

[Million barrels per day

| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case: [1] | | | | | | | | | | | | |
| Demand | 16.85 | 17.00 | 16.93 | 17.92 | 18.62 | 19.44 | 20.19 | 21.06 | 21.89 | 22.67 | 23.41 | 24.10 |
| Supply | 10.76 | 10.10 | 10.43 | 10.23 | 10.30 | 10.40 | 10.50 | 10.52 | 10.60 | 10.60 | 10.70 | 10.73 |
| Imports | 6.09 | 6.90 | 6.50 | 7.69 | 8.32 | 9.04 | 9.69 | 10.54 | 11.29 | 12.07 | 12.71 | 13.37 |
| Reductions in imports from: | | | | | | | | | | | | |
| Phased decontrol [2] | | −.01 | −.15 | −.40 | −.63 | −.82 | −.97 | −1.09 | −1.18 | −1.25 | −1.29 | −1.30 |
| Accelerated supply [3] | | 0 | 0 | 0 | −.47 | −.94 | −1.41 | −1.88 | −2.34 | −2.81 | −3.28 | −3.75 |
| Coal conversion | | −.06 | −.15 | −.19 | −.20 | −.20 | −.20 | −.20 | −.20 | −.20 | −.20 | −.20 |
| H.R. 6860: | | | | | | | | | | | | |
| Insulation credit | | −.02 | −.07 | −.11 | −.11 | −.11 | −.11 | −.11 | −.11 | −.11 | −.11 | −.11 |
| Auto standards | | 0 | 0 | 0 | −.13 | −.26 | −.36 | −.44 | −.51 | −.57 | −.62 | −.66 |
| 10-percent tariff | | −.06 | −.11 | −.18 | −.33 | −.48 | −.63 | −.79 | −.94 | −1.09 | −1.19 | −1.38 |
| Tax on business use of oil as fuel | | 0 | 0 | 0 | −.02 | −.03 | −.05 | −.08 | −.12 | −.15 | −.18 | −.21 |
| Total, H.R. 6860 | | −.08 | −.18 | −.29 | −.59 | −.88 | −1.15 | −1.42 | −1.68 | −1.92 | −2.10 | −2.36 |
| Imports with comprehensive program [4] | | 6.75 | 6.02 | 6.81 | 6.43 | 6.20 | 5.96 | 5.95 | 5.89 | 5.89 | 5.84 | 5.76 |

[1] The base case assumes a price of $11 in 1975 prices for 1975 to 1977 and a price of $8.35 in 1975 prices thereafter. Current price controls are maintained.

[2] This assumes decontrol over 30 months as proposed by the Administration.

[3] This includes accelerated development of the Outer Continental Shelf, development of the Alaskan Naval Petroleum Reserve and some use of oil shale.

[4] This includes phased decontrol, accelerated supply, coal conversion and H.R. 6860.

In the base case, demand stays roughly constant and supply falls in 1975 and1976. The high price and the economic slump combine to eliminate any growth in demand, which had previously been rising at more than a 5-percent rate. After 1978, the oil from Alaska's North Slope becomes available, but the sharp price decline assumed to occur in that year leads to a decline in production in the "lower 48" States that almost offsets the increased production in Alaska. The net effect of these assumptions is a gradual but small increase in U.S. supplies. The fall in price and the renewal of rapid economic growth, however, cause a resumption of rapid growth in demand for oil although at a slower rate than prior to 1973. Because demand grows faster than supply, oil imports rise to over 13 million barrels per day by 1985, over one-half of U.S. oil consumption.

This base case forecast is heavily dependent on the assumed price drop in 1978. If oil prices increase in 1978 from $11 in 1975 prices to $13 (relative to consumer prices generally) and oil prices are free from price controls, the FEA predicts that supply will increase to 15.8 million barrels per day (mbd) by 1985, instead of 10.7 mbd, and that demand will rise to only 19.2 mbd. In this case, imports are only 3.4 mbd, slightly more than one-half of current levels. Prices between $8.35 and $13 (in 1975 prices) lead to levels of imports between 13.4 mbd and 3.4 mbd. For example, an $11 price, one slightly below current prices, would result in imports of approximately 8 mbd. The assumption that the price of oil drops sharply, while perhaps not as realistic as other possible assumptions, is useful as a conservative planning assumption, one that guards against the worst likely case.

The "accelerated supply" case assumes a vigorous effort to expand supplies. This would require new legislation. By 1985, a program of accelerated supply could raise supply by almost 4 mbd, according to the FEA. This would reduce imports to 8.6 mbd by 1985 if an $8.35 price is assumed and would actually make the U.S. an oil exporter by 1985 at a $13 price.

The FEA predicts that phased decontrol would lower imports by 1:30 mbd by 1985. This consists of 0.8 mbd of reduced demand and 0.5 mbd of increased supply. At higher prices, the effects of decontrol are even greater.

It should be stressed that all of these estimates are extremely uncertain. There is little knowledge about how the demand for and supply of oil responds to changes in prices at the high prices that now prevail and about how successful oil drilling will be in the next ten years. The areas where "accelerated supply" could be obtained have not even been explored yet, so the 4 mbd estimate should be viewed with a possible error of perhaps 75 percent.

Table 6 also shows the effects on oil imports of H.R. 6860, as passed by the House. It is assumed that the President imposes a 10-percent tariff on both crude oil and refined products. The tariff both reduces demand for oil and, by allowing prices received by domestic producers to rise, increases supply. Under existing law, the administration can order utilties to convert from oil and gas to coal, and the FEA projects an energy saving of 0.2 mbd from that program. However, it is not clear that these administratively-ordered conversions will be achieved, and H.R. 6860 includes significant tax incentives for such conversions.

"Coal conversion" is listed as a separate item, but it should be understood that a part of it should properly be attributed to the tax incentives in the bill.

The table shows that, with the program for accelerated supply and coal conversion, phased decontrol and the enactment of H.R. 6860, oil imports can be expected to stay at manageable levels despite an assumed decline in the relative price of imported oil. Still greater reductions in imports could be achieved through the use of the quota system.

*Dimensions of the energy problem*

The overall energy problem in the United States really consists of several different, but related problems. The principal dimension of the energy problem today is the threat of a politically motivated oil embargo, a consequence of the overdependence of the United States and its allies on imported oil, particularly when the imports are concentrated in a small number of countries. A second important dimension is the effect of high oil prices in reducing the standard of living of oil consumers and raising that of the oil producers (foreign and domestic). A third one is the strain on the international monetary system that is imposed by the huge balance-of-payments surpluses of the oil-exporting countries and the corresponding deficits of the consuming countries. A fourth is the effect of the energy problem and responses to it on inflation and unemployment. A fifth dimension is the prospect of widespread shortages of natural gas, and a sixth one is the prospect of the depletion of our resource base of both oil and gas in the next few decades. One reason why the energy problem is so complicated is that policies designed to deal with one of these dimensions of the energy problem frequently make it harder to solve other aspects of the problem.

*Overdependence on oil imports.*—The United States relies on imports for 37 percent of its oil consumption, or 17 percent of its total consumption of energy. In 1973, the Arab countries supplied 26 percent of our oil imports (1.6 million barrels per day), if imports of refined products are traced to the source of the crude oil. The United States, however, also imported 1.1 million barrels per day from Canada, which imports an equal amount of oil for its Eastern provinces. Owing to Canada's own dependence on oil imports, then, 22 percent of which comes from Arab countries, imports from Canada cannot be considered secure sources of supply; and adding Canada's imports from Arab countries to our own would raise our dependence on Arab countries to 29 percent of imports, or 10 percent of oil consumption. (Canada has also announced a policy of phasing out oil exports to the United States by 1983.) In 1973, 30 percent of our oil imports came from Venezuela, 7 percent came from Iran and 9 percent came from Nigeria.

Our allies in Western Europe and Japan rely almost exclusively on oil imports and are also more dependent on the Arab countries. Western Europe received 69 percent of its oil from Arab countries in 1973, and Japan received 44 percent of its oil from that source. Our allies' dependence on imports is important since the United States and 11 other industrial countries have recently reached an *ad referendum* agreement on an oil sharing treaty which in certain circumstances could increase U.S. vulnerability to an oil embargo. Under the pro-

posed agreement, the countries would reduce oil demand by a common percentage in the event of an emergency like a general embargo. In the case of a selective embargo, the embargoed country would absorb a shortfall equal to 7 percent of its consumption, and the other members would share the remaining shortfall among themselves in proportion to their consumption. (For the United States and Canada, the 7-percent threshold is measured for major regions separately.) If, for example, the Arab countries cut back oil production by 50 percent, the United States would be obligated to reduce oil consumption by as much as 3 million barrels per day, a larger reduction than occurred during the selective Arab embargo against the United States. During that embargo, U.S. oil imports fell by approximately 2 million barrels per day, three-fourths of which consisted of imports of crude oil. Real gross national product (that is, GNP in constant prices) fell by 2.2 percent from its pre-embargo peak, but it is possible that some of this decline resulted from general weakness in the economy rather than from the embargo.

The forecasts of oil supply and demand cited above suggest that in the future the extent of our dependence on oil imports will depend partly on the price of oil. If the price rises modestly above existing levels in real terms (that is, relative to the overall rate of inflation) and oil is decontrolled, the overdependence problem should decrease appreciably after 1978, when production from Alaska's North Slope becomes available. If the price of oil drops by as much as one-third in real terms, however, the United States can be expected to be much more dependent on imports than at present.

There are several ways to deal with the threat of oil supply interruptions. An international oil sharing program helps reduce the vulnerability of the United States to a selective embargo, although it also increases American obligations under a general supply interruption. Enlarging U.S. stockpiles of oil would also reduce the costs of a supply interruption, and the administration has proposed that the United States accumulate 1.3 billion barrels of oil (75 days' consumption and 200 days' imports at current levels). The Senate has passed a bill that requires the U.S. to accumulate over the next seven years enough oil to replace 90 days' imports (over 500 million barrels at current levels). The problem with stockpiling is that if the oil is purchased in the world market, it reduces market pressures on OPEC to lower prices. Also, if the United States accumulates 1.3 billion barrels of oil at a price of $11 per barrel and the price falls to $7, the United States will have, in effect, taken a capital loss of $5.2 billion. To some extent, these problems would be avoided if oil from the Elk Hills Naval Petroleum Reserve or from any other new domestic source were used to build up the stockpile. Standby rationing or other conservation programs would also reduce vulnerability to an embargo by making it easier to cut back demand rapidly in those uses which are most wasteful. Diversifying the sources of our oil imports, and those of our allies, by encouraging oil production in new areas also would reduce the hazard of a politically motivated embargo.

The surest way to reduce our vulnerability to an embargo, however, is to reduce oil imports. If this is achieved by reducing U.S. demand for oil, there is a direct reduction in vulnerability to an embargo, although if the reductions in demand are in those uses, such as long-

distance pleasure driving, that could easily be curtailed by standby rationing or conservation programs, then cutting back when there is no embargo may be an unnecessarily painful way to deal with the threat of supply interruption. Reducing imports by increasing U.S. oil supply is another alternative. This can also be expensive, however, if the cost of the new domestic supplies exceeds the cost of imports, and increased U.S. supply can actually increase our reliance on imports in the future if it leads to more rapid depletion of our resource base. The best solution to the problem of overdependence on imports probably involves some combination of conservation, increased domestic supply and the other measures discussed above.

A second aspect of import dependence is reliance on foreign refineries. At the end of 1974 the U.S. had enough capacity to refine 14.2 million barrels of crude oil per day (mbd), more than enough to refine all domestically produced crude oil but more than 2 mbd less than would be necessary to free the U.S. from reliance on foreign refineries. In the fourth quarter of 1974, the U.S. imported 2.2 mbd of refined products, of which 23 percent was from the Netherland Antilles, 34 percent from Venezuela, 10 percent each from Canada and Trinidad, 7 percent from the Bahamas and 5 percent from Western Europe.

Reliance on foreign refiners increases U.S. vulnerability to supply interruptions, since presumably the nations in which the refineries are located could divert the oil to themselves instead of exporting it to the U.S. when there is a shortage. However, the diversity of our sources of refined petroleum products and the fact that many of them do not consume significant amounts of oil themselves suggest that this is a less serious problem than over-dependence on imported oil generally.

Currently, there is substantial excess refining capacity in the world because demand for oil has declined in the past two years as a result of high prices and the slump in the world economy. World refining capacity was 67.0 mbd at the end of 1974, which was about 20 percent above world crude oil production in that year of 55.8 mbd. Furthermore, the oil producing countries may decide to develop refineries of their own and give them preferential access to their crude oil, in which case excess refining capacity in the oil-importing countries would be even larger. Unless world demand for oil rises significantly, then, the business of oil refining may not be very profitable in the next several years.

*Decline in the standard of living of energy consumers.*—A second part of the energy problem is the effect of high oil prices in reducing the standard of living of energy consumers. The high price for imported oil established by OPEC leads to a transfer of income from oil-consuming nations to oil-producing countries. For the United States, the bill for imported oil rose from approximately $7 billion in 1973 to $23 billion in 1974, an increase of one percent of U.S. gross national product. Because prices are higher, the import bill should be even greater in 1975. For the non-Communist world as a whole, the additional import bill was $75 billion, or almost 2 percent of the GNP of the non-Communist countries. Some nations are affected more seriously than others. Italy's oil bill increased by 4 percent of GNP, and the United Kingdom's oil bill rose by 3 percent of GNP. Japan's

oil bill rose by about 2½ percent of GNP, and West Germany's oil bill by about 2 percent of GNP.

For the U.S. oil consumer there has also been a transfer from oil consumers to oil producers. Oil consumers paid $9 billion more for U.S.-produced crude oil in 1974 than in 1973, which was divided between higher profits of producers, higher taxes on them and higher costs. (There are no data on the precise division.) So far this year, the increased expenditures on U.S.-produced oil over 1973 is approximately $13 billion. Were old oil to be decontrolled immediately, another $18 billion would be added to the oil bill of U.S. consumers. Since this would involve no increase in costs, this added revenue would be divided between higher profits of producers and royalty holders (about $11 billion) and higher taxes on those profits (about $6 billion in corporate income taxes and $1 billion in State and local severance taxes.) Finally, the $2-per-barrel tariff imposed by President Ford has transferred approximately $3 billion from oil consumers to the government.

The increase in oil prices has also led to increases in coal and natural gas prices of about $4 billion. These have been much smaller than the rises in oil prices because the price of natural gas sold in interstate commerce is regulated and most coal and natural gas is sold under long-term contracts that limit price increases. As these contracts expire, there will probably be further price increases for coal and natural gas.

From the standpoint of the United States, the loss in real income resulting from the increase in oil prices is independent of whether expensive oil is imported or whether it comes from costly alternative sources of energy. In one case, there is an income transfer to the oil-producing countries; in the other case, there is simply a higher cost to the consuming countries without any benefits to any producers. (Of course, costly domestic energy sources are preferable to expensive imports from the standpoint of reducing vulnerability to supply interruptions.)

There are several ways to deal with the decline in the standard of living of oil consumers that results from high oil prices. For example, there could be a windfall profits tax on domestic producers designed to tax some part of the increased profits of producers. The revenues raised by the windfall tax, along with the increased corporate tax receipts, could be used to fund general tax reductions. The problem with a windfall profits tax is that it may discourage domestic oil production, especially if it applies to new or stripper oil. A windfall profits tax on old oil can still discourage secondary or tertiary recovery in the same manner as the existing price controls unless the tax is phased out over no more than five years and defines old oil appropriately. A plowback provision, which would reduce the incentive not to increase production, would also reduce the revenue available for general tax reduction.

However, decline in the standard of living of oil consumers resulting from high oil prices can be reversed completely only by lowering the price of oil, relative to consumer prices generally. The consuming countries can attempt to achieve a decline in oil prices by reducing the quantity of their oil imports and by expanding oil supplies in countries

that are not now members of OPEC. In the past, cartels have tended to collapse as individual producers sought to increase their market shares by cutting prices; but it appears that the OPEC cartel is less likely to break up because of its high profitability and because of several of its members, like Saudi Arabia, can reduce their oil exports without markedly reducing their standard of living.

The United States, by itself, is not likely to have much impact on OPEC. In 1973, the United States absorbed only 19 percent of world oil exports and only 9 percent of Arab oil exports. Even quite large percentage reductions in U.S. imports, then, are only small percentage reductions in the demand for OPEC, and especially Arab, oil.

Finally, if oil prices should decline, consumption can be expected to be greater and domestic production lower, so that our dependence on oil imports will be correspondingly larger. This would require stronger action to guard against the threat of a supply interruption.

*International monetary problems.*—The transfer of income to the oil producing countries consists, first, of a financial flow of money from the consuming to the producing countries and, subsequently, of a transfer of real goods and services. The revenues of the oil exporting countries rose to approximately $100 billion in 1974. This was offset by approximately $35 billion in purchases of goods and services from abroad and $5 billion in aid, leaving a current account surplus of $60 billion, compared to a $15 billion surplus in 1973. Thus, the oil-consuming countries are sending $35 billion worth of goods and services to the oil exporters and are accumulating a debt of $60 billion that, with interest, will be used to purchase goods and services in the future.

The large current account surpluses of the oil-producing countries create serious problems for the international monetary system. Large financial resources will be concentrated in a relatively small group of investors; this will put a great strain on the banking system, which traditionally relies on having a large number of relatively small depositors in order to minimize the risks of sudden large withdrawals. Also, the producing countries are unlikely to want to make the size of their investment in each consuming country precisely equal to that country's oil deficit, so that some countries will have trouble financing their oil deficits. It is necessary to decide who will assume the credit risks inherent in loans to weaker economies.

If the oil-producing countries are to run a $60 billion surplus on current account, the oil consuming countries as a group must have a $60 billion current account deficit. If any single consuming country unilaterally tries to reduce its current account deficit, the deficits of other consuming countries will increase, which could lead to retaliatory action that will reduce the volume of world trade without reducing the consuming countries' overall current account deficit. To prevent this, in May 1974, the nations participating in the Organization for Economic Cooperation and Development (OECD) have agreed not to take unilateral actions to improve their balance of payments.

The oil-producing countries will either have to invest their surplus in the consuming countries or build up their reserves of foreign currency. If the distribution of investments by the producing countries does not match the distribution of the consuming countries' oil deficits, then those countries that do not receive their pro rata share of invest-

ments will find the exchange rate of their currency falling, and the exchange rate of the countries who got more than their pro rata share of investments will rise. This will affect trade patterns among the consuming countries.

The producing countries may distribute their investments according to some noneconomic criterion, such as avoiding investments in countries that oppose them politically, although this is difficult to do owing to the highly-developed state of the world money market. For example, if the oil-producing countries want to discriminate against one country and instead place deposits in banks of a second country, the multinational banks can simply make loans in the first country using their deposits in the second country. If the oil producers choose to buy the securities of (say) the United States and avoid British securities, then the price of U.S. securities will be bid up, and investors will tend to sell U.S. securities and buy British securities, which will offset the discrimination. There are many multinational companies today who are constantly shifting funds between countries in response to relatively small differences in rates of returns, and their actions should reduce the possibility of discrimination by oil producers. The volume of "petrodollars," however, is so large that it may not be possible to rely on normal market forces to offset arbitrary actions by oil producers. Thus, the administration has proposed the establishment of a "safety net" to lend money to countries that have difficulty financing their oil deficits.

The issues are more complex if the oil-producing countries choose not to invest in countries with weak economies, like Great Britain, Italy, and the less-developed countries. In this case, the private market cannot be expected to "recycle" the oil surpluses since the countries not receiving their pro rata share of investments really are bad credit risks. A "safety net" would, in this case, have the effect of artificially propping up currencies whose equilibrium values are lower, which prevents normal exchange rate adjustments from taking place.

Currently, the United States is now running a surplus in its balance of trade and is in the position of receiving more than enough investments from the oil-producing countries. In the first quarter of 1975, the United States had a current account surplus of $2 billion. U.S. banks are "recycling" the excess petrodollars by lending abroad.

Banks, however, face a potentially serious problem in accepting large deposits from oil producers. Banks typically make long-term loans that are financed by short-term deposits. If they have a large number of depositors who act independently of one another, banks can be fairly sure that statistically they will be able to predict their withdrawals so that they can manage their assets accordingly. However, if their deposits are concentrated, the banks risk sudden outflows of deposits, which can lead to bank failure if those deposits were being used to finance long-term loans. This threat to the banking system is made more serious by the absence in the Eurocurrency market (where most OPEC deposits have been placed) of bank supervision, deposit insurance, and a lender of last resort—functions that in the United States are fulfilled by the Federal Reserve System and the Federal Deposit Insurance Corporation.

Many of the international monetary problems associated with the rise in oil prices will worsen over time as the oil exporters accumulate more and more wealth. Projections of just how much wealth the exporting countries will accumulate are very sensitive to assumptions about the price of oil, the level of exports and the growth rate of imports by the producing countries; such estimates vary widely. It now appears likely that these accumulations by the oil exporters will be manageable.

*Macroeconomic implications of high oil prices.*—The sharp increase in oil prices appears to have been an important factor in the current recession, and the decontrol of oil prices in the absence of any other actions could be expected to make this problem worse. The transfer of income resulting from the increase in oil prices—approximately $33 billion so far, an additional $18 billion if oil prices are decontrolled, and still more if the price of imported oil rises or the President imposes an additional dollar license fee for oil imports—tends to shift income from people with a high propensity to spend (generally, lower income consumers) to people, businesses, or governments with a lower propensity to spend in the U.S. economy. This tends to reduce overall spending in the economy and thereby increase unemployment. Also, higher prices for gasoline, and the prospect of still greater increases in the future, have helped depress car sales. Finally, the higher rate of inflation caused by the oil price increases also tends to retard real economic growth.

The United States paid $16 billion more for its oil imports in 1974 than in 1973. To some extent, the oil exporters offset this outflow by increasing their purchases of U.S. goods and services, but since the worldwide increase in such purchases by the oil exporting countries in 1974 was only an estimated $20 billion, there clearly was a large net reduction in spending on U.S. goods and services. An additional $13 billion is being transferred from U.S. oil consumers to U.S. oil producers in higher after-tax profits and to the government in higher corporate income and severance taxes. Most of this would have been spent on other consumer goods. To some extent the decline in consumer spending by oil consumers is offset by increased investments by oil producers and by consumer spending by shareholders of oil companies who receive increased dividends. These offsets have not been complete, however, so the income transfer leads to some net reduction in spending. Finally, consumers are paying $3 billion to the Government as a result of the $2 import license fee imposed by President Ford, which has not been offset by increased spending.

Higher oil prices also tend to reduce purchases of new cars. Experience shows that for each penny by which the price of gasoline rises relative to consumer prices generally, new car sales can be expected to fall by roughly 50,000 units. Thus, it appears that the rise in the relative price of gasoline of approximately 10 cents in 1974 was responsible for a reduction in car sales of approximately 500,000 units, or $2 billion of spending. It is estimated that the decontrol of oil prices would raise the price of gasoline by 8 cents per gallon, and on this same basis could be expected to cause a further reduction in car sales of about 400,000 units.

Increased oil prices also have an inflationary impact. The increased inflation caused by higher oil prices in 1974 is estimated at approximately 1.8 percent; decontrol could be expected to cause an additional price increase of 1.3 percent; and any price increase by OPEC would cause still further price increases. Higher rates of inflation tend to reduce the level of economic activity because they make consumers less confident and less willing to spend, and because they increase the demand for money and thus raise interest rates. Recently, inflation has also caused the Federal Reserve to pursue a more restrictive monetary policy, leading to still greater increases in interest rates.

It is difficult to quantify these effects of higher oil prices on the level of economic activity. However, a study by the Congressional Budget Office recommends a tax cut of $15 billion to offset them. If the revenue from a windfall profits tax and the increased imports tax receipts from the profits from decontrol total $10–12 billion, there could be a tax reduction for individuals equal to this amount.

*Natural gas shortages.*—Thirty percent of the energy consumed in the United States is derived from natural gas, and there are likely to be serious shortages of that fuel for the rest of this decade unless substantial changes are made. Price controls on gas sold in interstate commerce prevent price increases that would eliminate the gap between the supply and demand for natural gas in the interstate market, while the absence of controls on the price of intrastate gas (that is, gas sold within the State in which it is produced) diverts supplies away from the interstate market, thereby aggravating the shortage. While the United States does import 4 percent of its gas consumption, gas imports are not readily available, because of high transportation costs. As a result, imports cannot fill the gap between gas supply and demand as they do for oil.

The results of the natural gas shortage to date have been curtailments of service to so-called "interruptible customers," mainly businesses, and the inability of new residential customers to obtain gas hookups in many areas. As a result, some customers have switched to oil, thereby aggravating the problems associated with overdependence on oil imports, and some businesses have simply had to shut down, thereby increasing unemployment.

Proved reserves of natural gas peaked in 1967, but gas producers continued to increase supply by making more intensive use of existing reserves until 1973. As a result, proved gas reserves (excluding Alaska) have declined by 25 percent since 1967, which ensures that in the absence of significant changes the gas shortage will be even worse in the rest of this decade if present policies are continued. The sharp price increases for natural gas that have occurred in recent years have led to increased drilling for gas, but this has not been sufficient to offset the rapid exhaustion of existing gas fields.

*Eventual depletion of U.S. resource base.*—Both oil and gas are depletable resources, and the United States must prepare for the day when it will run out of them. A recent study by the U.S. Geological Survey estimates that the United States has 144 billion barrels that have either been discovered and not yet extracted or that remain to be discovered. If the U.S. production is maintained at current levels,

these resources would be enough for 47 years, but if production returns to its peak 1970 level and then grows at a rate of 3 percent annually, the resources would be exhausted after 22 years. The Geological Survey also estimates that the United States has 923 trillion cubic feet of natural gas, enough for 43 years consumption at current levels.

TABLE 7.—ESTIMATED OIL AND GAS RESOURCES

| Area | Oil | | | Gas | | |
|---|---|---|---|---|---|---|
| | Demonstrated reserves [1] | Inferred reserves [2] | Undiscovered recoverable resources [3] | Demonstrated reserves [1] | Inferred reserves [2] | Undiscovered recoverable resources [3] |
| Lower 48 States: | | | | | | |
| Onshore | 25.4 | 14.3 | 44 | 169.5 | 119.4 | 345 |
| Offshore | 3.4 | 2.6 | 11 | 35.8 | 67.4 | 63 |
| Alaska: | | | | | | |
| Onshore | 9.9 | 6.1 | 12 | 31.7 | 14.7 | 32 |
| Offshore | .2 | .1 | 15 | .1 | .1 | 44 |
| Total | 38.9 | 23.1 | 82 | 237.1 | 201.6 | 484 |

[1] Demonstrated reserves are those that are known to exist.
[2] Inferred reserves are those reserves that can reliably be expected to be discovered in or near existing fields.
[3] Undiscovered recoverable resources are those that have not yet been discovered.

Source: U.S. Geological Survey, "Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States," 1975.

The existence of these resources is known with varying degrees of certainty. "Demonstrated reserves" are those reserves that we know to exist. These amount to 39 billion barrels of oil and 237 trillion cubic feet of natural gas, as shown in table 7. About two-thirds of the demonstrated reserves of oil and gas are onshore in the "lower 48" States.

"Inferred reserves" are those reserves that are expected to be added to existing fields. These are not known with certainty, but past experience with discoveries adjacent to existing reserves makes it possible to estimate "inferred reserves" reliably. These amount to 23 billion barrels of oil and 202 trillion cubic feet of gas. About 60 percent of "inferred reserves" are onshore in the lower 48 States.

"Undiscovered recoverable resources" are those deposits in fields that have not yet been discovered. These are known with very little certainty but can be estimated statistically using information about geological characteristics of regions that have yet to be explored intensively and data about past discovery rates in areas that have been explored. The Geological Survey estimates an expected value of 82 billion barrels of oil and 484 trillion cubic feet of gas for this latter category. About one-half of the oil and two-thirds of the gas is estimated to be onshore in the lower 48 States. The Survey estimates that there is a 90-percent probability that undiscovered recoverable resources are in the range 50 to 127 billion barrels for oil and 322 to 655 trillion cubic feet for gas. The greatest uncertainty is associated with the offshore and Alaskan oil.

These estimates assume the oil and gas prices that prevailed prior to the price hikes in 1974. Continuation of higher prices, which is likely, should encourage the use of enhanced recovery techniques and, therefore, increase the amount of recoverable resources, possibly by a large amount.

*Administration energy program*

The main elements of the Administration program, announced by President Ford in his State of the Union Message in January 1975, were decontrol of the prices of oil and natural gas newly dedicated to the interstate market, a $2 per barrel excise tax and import tariff on crude oil, a 37-cent per mcf excise tax on natural gas, a windfall profits tax on oil, and general tax reductions designed to return to the economy most of the revenues raised from the tax increases—approximately $30 billion. The President proposed that all of these changes take place in 1975.

The President also announced a set of actions that he planned to take to enact as much of his program as possible administratively and to spur Congress to enact the rest of it. These actions were a $3 per barrel increase in the import license fee for crude oil, a $1.20 per barrel increase in the import license fee for refined products and decontrol of oil prices, which the President can accomplish subject to an either-House veto (or which will occur automatically if the underlying statute is allowed to expire on August 31, 1975). Also, the President proposed to eliminate the entitlements program for imports of refined products, which would cost these importers an amount at least equal to the $1.80 difference in the license fees on crude oil and petroleum products. So far, the President has increased the license fees on crude oil by $2 and the fee on petroleum products by $0.60, and has submitted a decontrol plan to Congress.

There have been three principal problems raised with respect to the President's program. These involve its impact on the overall economy, its reliance on the price system to conserve energy, and its emphasis on broad-based conservation taxes.

It has been suggested that the administration energy program is likely to aggravate the problems of inflation and unemployment, although there is general agreement that this is much less true of the legislative program than of the administrative program. It is estimated that the full administrative program—decontrol of oil and the tariff—would reduce the real income of oil consumers by $25 billion if there are no offsetting tax reductions. This would be offset to some degree by more spending by oil producers or the shareholders of oil companies, but it appears that the net reduction in spending still would be substantial. Also, it is estimated that this would result in a reduction in car sales of roughly 500,000 units, and an increase in the price level of almost 2 percent. The administration's legislative program included tax reductions that would have offset much of the reduction in consumers' purchasing power, although probably not all of it. Any adverse economic impact of the administration's program was made worse by its being put into effect entirely in mid-1975, the trough of the worst recession since the 1930's.

A second question raised about the administration's program is that it would be ineffective in solving the energy problem because it relies entirely on price increases to reduce demand and increase supply. Here, the evidence is not clear. Since the United States has never experienced prices for oil and gas as high as those envisioned in the administration's program, it is difficult to estimate how consumers and

producers will respond. Europe and Japan's experience with high oil prices suggests that they are effective in curtailing demand over a period of time, but there is hardly any evidence, one way or the other, on their effect in increasing supply.

Questions have been raised about whether the administration's emphasis on general tax and price increases on oil and gas was appropriate, and whether instead there should be a "tilt" towards certain uses or users of oil and gas, particularly automobile drivers and industrial users. Such a tilt could be achieved with specific taxes on gasoline, inefficient cars, or industrial uses of oil and gas, or through a use of price controls to tilt price increases towards gasoline.

The different regions of the country consume proportionately different amounts of the various types of energy, and this may have influenced responses to the administration program. Table 8 shows the percentage distribution of energy consumption by major region of the country for the various energy sources for 1972. The New England, MiddleAtlantic, and South Atlantic States consume a smaller share of the total energy but a larger share of the petroleum than their share of the population. The West south-central region, however, consumes a much larger fraction of all sources of energy except coal and hydropower than its share of popualtion. All of these regions would be disadvantaged relatively by an excise tax on crude oil. The West south-central region would also pay a disproportionate share of an excise tax on natural gas.

Table 9 shows the consumption of petroleum products by region for 1973. The New England and the Middle Atlantic States consume a disproportionately large share of the fuel oil, but a relatively small share of the gasoline. These regions would, therefore, benefit from a tilt towards gasoline.

TABLE 8.—ENERGY CONSUMPTION BY REGION, 1972

[Percent of total]

| Region [1] | Population | Personal income | Consumption of— Petroleum | Coal | Natural gas | Hydropower-nuclear | Total energy |
|---|---|---|---|---|---|---|---|
| New England | 5.8 | 6.2 | 8.6 | 0.3 | 1.2 | 4.5 | 4.4 |
| Middle Atlantic | 18.1 | 20.1 | 19.5 | 16.7 | 8.4 | 12.3 | 14.9 |
| East north-central | 19.6 | 20.7 | 15.9 | 38.6 | 18.6 | 7.1 | 20.5 |
| West north-central | 8.0 | 7.6 | 7.5 | 7.1 | 9.2 | 5.5 | 7.9 |
| South Atlantic | 15.3 | 14.3 | 16.1 | 17.4 | 7.1 | 7.0 | 12.8 |
| East south-central | 6.3 | 4.9 | 4.8 | 14.0 | 5.4 | 7.7 | 6.8 |
| West south-central | 9.6 | 8.2 | 11.7 | .6 | 32.8 | 1.2 | 16.2 |
| Mountain | 4.3 | 3.7 | 4.3 | 4.7 | 5.9 | 8.9 | 5.1 |
| Pacific | 13.0 | 14.5 | 11.7 | .6 | 11.4 | 45.9 | 11.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

[1] The regions are: New England—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut. Middle Atlantic—New York, New Jersey, Pennsylvania. East north-central—Ohio, Indiana, Illinois, Michigan, Wisconsin. West north-central—Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas. South Atlantic—Delaware, Maryland, District of Columbia, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida. East south-central—Kentucky, Tennessee, Alabama, Mississippi. West south-central—Arkansas, Louisiana, Oklahoma, Texas. Mountain—Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada. Pacific—Washington, Oregon, California, Alaska, Hawaii.

Source: U.S. Bureau of Mines.

TABLE 9.—CONSUMPTION OF PETROLEUM PRODUCTS BY REGION, 1973 (PERCENT OF TOTAL)

| Region [1] | 1972 | | | | |
|---|---|---|---|---|---|
| | Population | Personal income | Distillate fuel oil | Residual fuel oil | Gasoline |
| New England | 5.3 | 6.2 | 10.8 | 16.0 | 4.9 |
| Middle Atlantic | 18.1 | 20.1 | 23.3 | 29.9 | 13.6 |
| East north-central | 19.6 | 20.7 | 18.3 | 6.8 | 19.2 |
| West north-central | 8.0 | 7.6 | 7.9 | 1.5 | 9.4 |
| South Atlantic | 15.3 | 14.3 | 12.3 | 22.9 | 16.4 |
| East south-central | 6.3 | 4.9 | 4.7 | 1.2 | 6.8 |
| West south-central | 9.6 | 8.2 | 8.9 | 5.7 | 11.3 |
| Mountain | 4.3 | 3.7 | 5.4 | 1.5 | 5.4 |
| Pacific | 13.0 | 14.5 | 8.4 | 14.6 | 12.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

[1] The regions are: New England—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut. Middle Atlantic—New York, New Jersey, Pennsylvania. East north-central—Ohio, Indiana, Illinois, Michigan, Wisconsin. West north-central—Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas. South Atlantic—Delaware, Maryland, District of Columbia, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida. East south-central—Kentucky, Tennessee, Alabama, Mississippi. West south-central—Arkansas, Louisiana, Oklahoma, Texas. Mountain—Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada. Pacific—Washington, Oregon, California, Alaska, Hawaii.

Sources: U.S. Bureau of Mines, U.S. Department of Transportation.

The consumption of different kinds of energy also varies by income class. While the consumption of all kinds of energy declines as a fraction of income as income rises, the decline is greatest for heating fuels and least for gasoline, with electricity somewhere in between.

It is also argued that the consumption of gasoline and of fuel used in industry is more responsive to price increases than in the consumption of heating fuel. To the extent this is true, this would mean that more conservation could be achieved with a given price or tax increase if the increase were tilted toward gasoline and the industrial use of fuel.

The main argument in favor of the broad-based administration approach is that there is waste in all uses of oil and gas and that it is both less painful and more equitable to cut back usage in all areas than to concentrate the conservation on only certain uses.

*House bill*

The approach taken in H.R. 6860 differs from the administration proposal. As reported by the Ways and Means Committee, the bill included energy conservation and conversion measures designed to reduce selected uses of oil and gas which the Ways and Means Committee felt were most wasteful and could be reduced with the least economic disruption. These include a 23-cent gasoline tax, a tax on auto companies that fail to meet certain fuel economy standards, a tax on the business use of oil and gas as fuel, and a tax credit for home insulation. The President's authority to impose import tariffs or license fees on oil was limited to a maximum of 10 percent ad valorem, or $1 per barrel, whichever is higher. To ensure that these conservation and conversion measures lead to reduced imports rather than reduced U.S. production, the bill imposes a mandatory, but flexible, import quota. The flexibility of the quota, however, also would enable the President to use it as a conservation measure in its own right, in which case import licenses are to be distributed by public auctions.

The major conservation measure, the gasoline tax, was deleted on the House floor. The auto efficiency tax, however, was replaced by a program of auto efficiency standards enforced with civil penalties. Also, several exceptions to the tax on business use of oil and gas as fuel were added. As a result of these floor amendments, it is much more likely that the quota will act to reduce oil imports somewhat.

Specific issues relating to H.R. 6860 will be analyzed in detail in subsequent pamphlets. One principal general issue is whether the selective approach to demand restraint in the House bill is preferable to the general approach of the administration proposal and, if the selective approach is preferred, precisely which uses of oil and gas should be curtailed. Another major issue is the extent to which the bill should attempt to encourage increased supply of oil and gas rather than to emphasize demand reduction.